CHAPTER 52

CENTRAL HARDWOODS

TYPE DESCRIPTION

A. Stand Composition

Contains more than 50% upland hardwood species or type; no specie or type constitutes over 50% of the stand. This forest type would primarily be found south of Wisconsin's Vegetative Tension Zone (Curtis, 1959); see map 52.1. However, it also occurs on dry mesic sites in the north. Predominant species include those of moderate to high shade tolerance: basswood (Tilia americana), red maple (Acer rubrum), sugar maple (Acer saccharum), white ash (Fraxinus americana), shagbark hickory (Carya ovata), bitternut hickory (Carya cordiformis) and elm (Ulmus sp); and other species of low to moderate tolerance - Black walnut (Juglans nigra), butternut (Juglans cinera) , oaks (Quercus sp.) and white pine (Pinus strobus).

In the past most of these stands have been burned, grazed and harvested in various ways. Generally, harvesting removed the most valuable species and the highest quality stems, especially oak. This has produced many low density, low quality stands with high density shrub layers. Species present include the early successional species. Stands often have low productivity even on the better sites. These stands are often called "degraded central hardwoods".

B. Associated Species

Intolerant: Aspen (Populus sp.), black cherry (Prunus serotina), box elder (Acer negundo), white birch (Betula papyrifera) and eastern red cedar (Juniperus virginiana).

Moderate to tolerant: Hackberry (Celtis occidentalis) and ironwood (Ostrya virginiana).

C. Soil Preference

Well drained soils ranging from loamy sands through the loams, alluvial soils and also those soils originating under prairie grasses.

D. Range of Habitat Types

The central hardwoods type occupies a wide range of sites in Wisconsin, including all aspects, slope positions and a wide range of soils. The Vegetation of Wisconsin (Curtis, 1959) divides Wisconsin into northern and southern floristic provinces reflecting cumulative differences in climatic conditions. Within each province he described five types of forest communities: dry, dry-mesic, mesic, wet-mesic, and wet. However, these community types were based entirely on differences in tree species composition and do not necessarily represent the site conditions. For example, a mixed red-white oak forest is classified as dry-mesic, but it could also be found on mesic sites where historic fires have eliminated "mesic" hardwoods. For this reason Curtis' community types cannot be used reliably to classify site types.

The following description of community types refer to this division as being either north or south of Wisconsin's Vegetative Tension Zone (Map 52.1). Kotar is currently conducting research to establish habitat classifications for southern Wisconsin (1993).

1. Southern Dry Forest

Includes dry upland forest where bur oak (Quercus macrocarpa), black oak (Q. velutina), northern pin oak (Q. ellipsoidalis), or white oak (Q. alba) are dominant. Associated species include shagbark hickory, black cherry, aspen, and paper birch.

Habitat types will be added as research is completed.

2. Southern Dry-Mesic Forest

   Includes upland forests where red oak (Q. rubra) or white oak dominate. Associated species may include basswood, shagbark hickory, black cherry, red maple, and black walnut.

   Habitat types will be added as research is completed.

3. Northern Dry-Mesic Forest

   Includes upland forests with sandy loam to loam soils where red oak, white pine, aspen, paper birch, and red maple dominate. White oak and many of the mesic hardwood species (basswood, ash, sugar maple, etc.) are also found on these sites.

   Habitat types supporting dry-mesic forest include PAm, AVDe, AA, PHV, AVVib, and AQVib (Kotar et al., 1988).

4. Southern Mesic Forest

   Includes moist upland sites where sugar maple and basswood are dominant. Associated species include red oak, black cherry, ironwood, white ash, and red maple.

   Habitat types will be added as research is completed.

5. Northern Mesic Forest (rare)

   Includes upland sites with loamy sands to silt loams where red oak and most northern hardwood species, especially sugar maple, dominate. White oak, American elm (Ulmus americana), American beech (Fagus grandifolia), and hemlock (Tsuga canadensis) are also common on many of these sites.

   Habitat types within this moisture-nutrient regime are AViO, AH, ACACi, ATD, ATM, AFD.

Silvical Characteristics
(for other species see appropriate chapters)

Species[1]	Hickory Carya Ovata	American Elm Ulmus Americana	Hackberry Celtis Occidentalis	Cherry Prunus serotina
Flowers	April-June Leaves nearly full size	2-3 weeks before leaves unfold	May - with or shortly after leaves	May - near fall leaf growth
Fruit Ripens	Sept.-Oct.	May-June	Sept.-Oct.	Aug.-Sept.
Seed Dispersal	Fall-Gravity	By Mid-June Wind-Disseminated	Fall to Winter Birds/Small mammals	Fall, Mammals
Seed Bearing Age	Age 40 - earliest 60+ optimum	As early as age 15 Abundant by age 40	--	As early as 10 years/up to 180
Interval between seed crops	1-3 years	Most years unless flower/fruit frozen (2-4 yrs. for red elm)	Most years have good crops	3-4 years

Seed viability	Ave. 80%	Ave. 63% Ave. 23% - red elm	Ave. 47%	Ave. 86%
Germination:				
Season	Spring	Spring-within 6-12 days but up to 60 days. Can be dormant for 1 year. Red elm 60-120 days.	Early Spring	Spring
Cold stratification	33-40°F 90-150 days	60 days @ 41°F 60-90 days for red elm	40° 60-90 days	40° 90-120 days
Temperature	68-86°F	50-70°F (65-85 optimum)	68-86°F	55-80°F 30 days
Seedling development	Moist seedbed-long taproot-12" by 1 year	Moist litter, moss, decayed material-less on mineral soil. Best growth in full sun (1st yr. best in 1/3 sunlight).	Mostly within hardwood stands. Grows slowly in heavy shade.	Best in full sun; rapid juvenile growth. Seedlings can emerge from seed buried in litter/loose dirt from one to several inches deep. Subject to frost damage. Taprooted for several years, then shallow rooted.
Shade Tolerance	Moderately tolerant - suppressed trees recover rapidly when released. Climax specie in type.	Intermediate - Responds well to release - favored by heavy cuttings. Red elm - adapts well in sub-climax or climax forests.	Moderately tolerant - suppressed trees are of poor form.	Intolerant - Intermediate and suppressed decline rapidly to death. Little response to thinning.
Vegetative Regeneration	100% stump - sprouting through 8" diameter, then rapidly decreasing.	Vigorous sprouter in youth - tend to be near cut edge, hence are unstable. Red elm - also vegetatively by rhizomes.	Cuttings and layering. Only small trees sprout.	Sprouts readily in all sizes. Large stumps have poorly formed sprouts. Rapid sprout growth.
Major Pests	Hickory bark beetle.	DED - when older. Leaf beetles, aphids.	Gall-producing insects - "Witches - brooming" cause by a mite.	Black-knot fungus Tent caterpillars

* Data compiled from USDA-FS Silvics of North America-Vol. 2 (1990) and USDA-FS Woody Plant Seed Manual (1974).
1) Only species not listed in other chapters are listed here.

MANAGEMENT ALTERNATIVES

Management objectives on most sites are a blend of the landowners values and DNR policy (societal values). As knowledge of the landscape level requirements of plants and animals becomes more refined management objectives will become more diverse. Biodiversity, landscape level ecology, endangered species and endangered habitats all need to be recognized in silvicultural systems. This Handbook doesn't have a chapter on ecological or biodiversity principles, but managers are encouraged to seek training and implement management objectives meeting the needs of the landowner.

Some tools available to the land manager to help identify alternative management objectives are the Heritage Inventory, the Endangered and Threatened Species List, and the USDA-Forest Service Central Hardwood Notes.

Forest management objectives should be determined in relation to other local and landscape scale land management objectives using the habitat type, when available. (A Habitat Type Field Guide for the southern one-half of the state should be available in 1994.) In lieu of habitat type site index curves, site physiography and soils should be used as a measure of site potential.

Management alternatives include:

A. Managing for quantity and quality of desirable or owner preferred species within ecological and economic limitations. Interplanting or underplanting are important management practices.

B. Allowing natural conversion to other successional types, or to more shade tolerant central hardwoods on appropriate habitat types.

C. Artificially converting to other species/types.

SILVICULTURAL SYSTEMS

Uneven-aged management by group selection or even-aged management by clear cutting and shelterwood methods are all suitable systems depending on species to be managed for and the status of advance reproduction.

MANAGEMENT RECOMMENDATIONS

Opportunities exist to meet a multitude of management objectives due to the diversity of species and their occurrence over a wide range of sites.

If timber or wildlife production are the primary objectives, maintenance of an oak component should be paramount.

Black walnut, because of its economic potential, should be managed on an individual tree basis where it exists on productive sites.

American elm and butternut can be managed to encourage long term presence in Wisconsin forests by reserving apparently resistant trees. Such phenotypically based individual tree management decisions may encourage development of disease resistant strains of trees.

On mesic and dry-mesic sites where past land use has not eliminated the northern hardwood species (seed source) natural succession to a climax northern hardwood type often occurs.

Where management objectives are for species other than central hardwoods, chapters specific to the timber type should be referenced.

A. Seedling-Sapling Stands (0-5" DBH)

On good sites, release dominants and co-dominants from direct crown competition. Favor species according to objectives established for the stand. Select individuals that will make high quality crop trees. Apply a crown release that provides the tree crown room to grow on all sides. Release 75 to 150 saplings/acre. Release of less than 75 saplings/acre of valuable species such as oak or walnut is still desirable. Do not remove all non-crop trees.

On lower quality sites, release should be used only to control species composition. Favor species that are well suited to the site. Oak stump sprout clumps should be thinned preferably before age 15 (Johnson and Rogers - 1980). Pruning should be considered only for black walnut (see Chapter 45).

Unless stands are overstocked with desirable species having good stem quality (see stocking chart, Figure 52.1), thinning under age 20 does little for eventual board foot volume (Gingrich - 1971). Carrying costs of these

early thinnings are high. If an immature stand is understocked, do not cut in it at all, except to maintain oaks (see Chapter 14, the timber stand improvement guides) or release walnuts, or to accomplish objectives related to crop tree selection such as a wildlife crop tree or shrub.

B. Pole Stands (5-11" DBH)

Stands should be thinned using stocking charts (Figure 52.1) for guidance. Thin to the B-level favoring dominant and co-dominant stems of better quality species and form. Thin first on good quality sites.

In stands with few desirable stems thinning should be applied primarily as a crop tree release. As the stand develops, further thinning may be desirable.

Generally, the younger the stand is when thinning (or non-commercial thinning) begins, the greater the increase in merchantable cubic-foot yield over the management period. On oak site index 65 and 75, however, board foot yields are greatest when first thinned at age 30-40, due to the increase in diameter increment (Gingrich). The benefits of thinning are generally not realized if the initial management practice is begun later than age 60. If stands are not thinned by age 60, it is generally better to carry them to rotation age without thinning or regenerate those in poor condition before the end of the usual rotation period. The oak site index curves are in Chapter 41.

C. Sawtimber Stands (> 11" DBH)

For stands younger than the desired rotation age (oak site index) or rotation diameter, continue to thin stands to the B-level or above (Figure 52.1). Always initiate thinnings before the A-level is reached. Thinning intervals may vary, depending on site quality and the residual stocking after the last cut. Ten to twenty years is typical.

Stop thinning at approximately three-fourths of the desired rotation age. This will reduce understory competition for new seedlings that regenerate after harvest.

Heavily cut stands with low quality, mature stems, may need a regeneration harvest. In that case adequacy of advance reproduction should determine how the stand is to be managed. See regeneration techniques for mature stands.

D. Regeneration Techniques - Mature Stands

Reproduction should be evaluated using the methodology described in "Managing Oak in the Driftless Area" (Jacobs). Oak regeneration can also be evaluated using the method in Chapter 41.

1. Adequate Reproduction

   If adequate oak reproduction is present and oak is the desired type, the recommendations in Chapter 41 should be followed.

   On mesic sites where tolerant northern and/or central hardwoods are regenerating, natural conversion to tolerant hardwoods should be the goal. When reproduction is waist high or taller, the overstory should be removed. This may be done in one or more cuts depending on the volume to be harvested, the silvical needs of the reproduction, and other management goals. Logging with adequate snow cover will reduce damage to new seedlings.

2. Inadequate Regeneration

   In a high percentage of central (often degraded) hardwood stands, dense shrub layers prevent adequate regeneration. On mesic cove sites ferns may be the main competition; they prevent light from reaching the forest floor and are allelopathic to trees. When ironwood or prickly ash is present in large numbers a secondary "canopy" of shade is created preventing adequate regeneration.

Where tolerant northern and central hardwood species are present and conversion is possible and desirable, group selection or shelterwood methods can increase regeneration. Sugar maple is favored by creating openings 25 to 40 feet in diameter with 5 to 8 openings per acre. Within openings all stems 2" DBH and larger should be cut and/or killed. White ash and basswood are favored using a shelterwood method instead of the group selection method. Chapter 40 provides details of northern hardwood management.

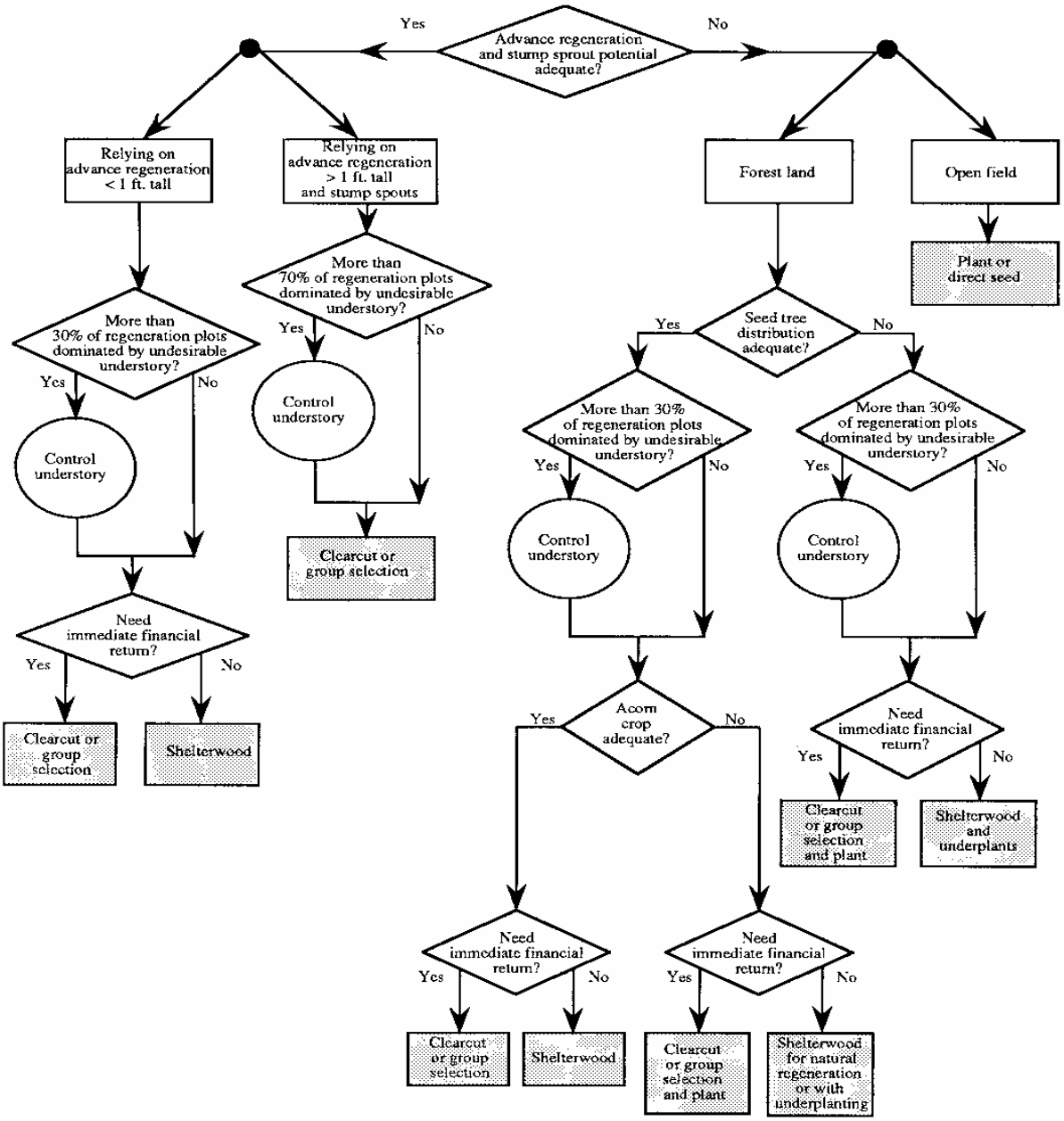
Where oak is present in central hardwood stands and maintenance or increase of the oak component is desired, the advance regeneration and stump sprout potential should be evaluated as indicated above; a flow chart depicting the decision making process is found on the following page. Additional information on oak management can be found in the aforementioned publication (Jacobs) and Chapter 41 of this Handbook.

In central hardwood stands where conversion to tolerant hardwoods is not expected, control the brush and wait for natural tree regeneration to become established. Because natural regeneration originates from trees on the site, acceptance of the species present is necessary. Undesirable seed trees can be treated to prevent their reestablishment in the next stand.

Stands could also be converted to another type using an appropriate harvest method or design with tree planting. When planting an area, competition must be controlled. On sites with oak site index 60 and above the competition should be cut or killed and the site planted with the selected species. Guidelines for planting oak and northern hardwood species are presented in their respective chapters. Use the reforestation chapter (Chapter 12) for site and species selection criteria. The flow chart can also be referenced, and as habitat types are developed for southern Wisconsin, they can be utilized for the decision making process

Planting of black walnut should follow very strictly the soil preference criteria found in the walnut chapter (Chapter 45). Competition control is also very important with black walnut.

Regeneration Strategies (Jacobs, 1992)



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Map 52.1 Vegetative tension zone of Wisconsin (Curtis, 1959).

Summary of range limits for 182 species. The figures in each county indicate the number of species attaining a range boundary there. The shaded band is the tension zone. Its exact location was determined from the densest concentration of individual range lines.

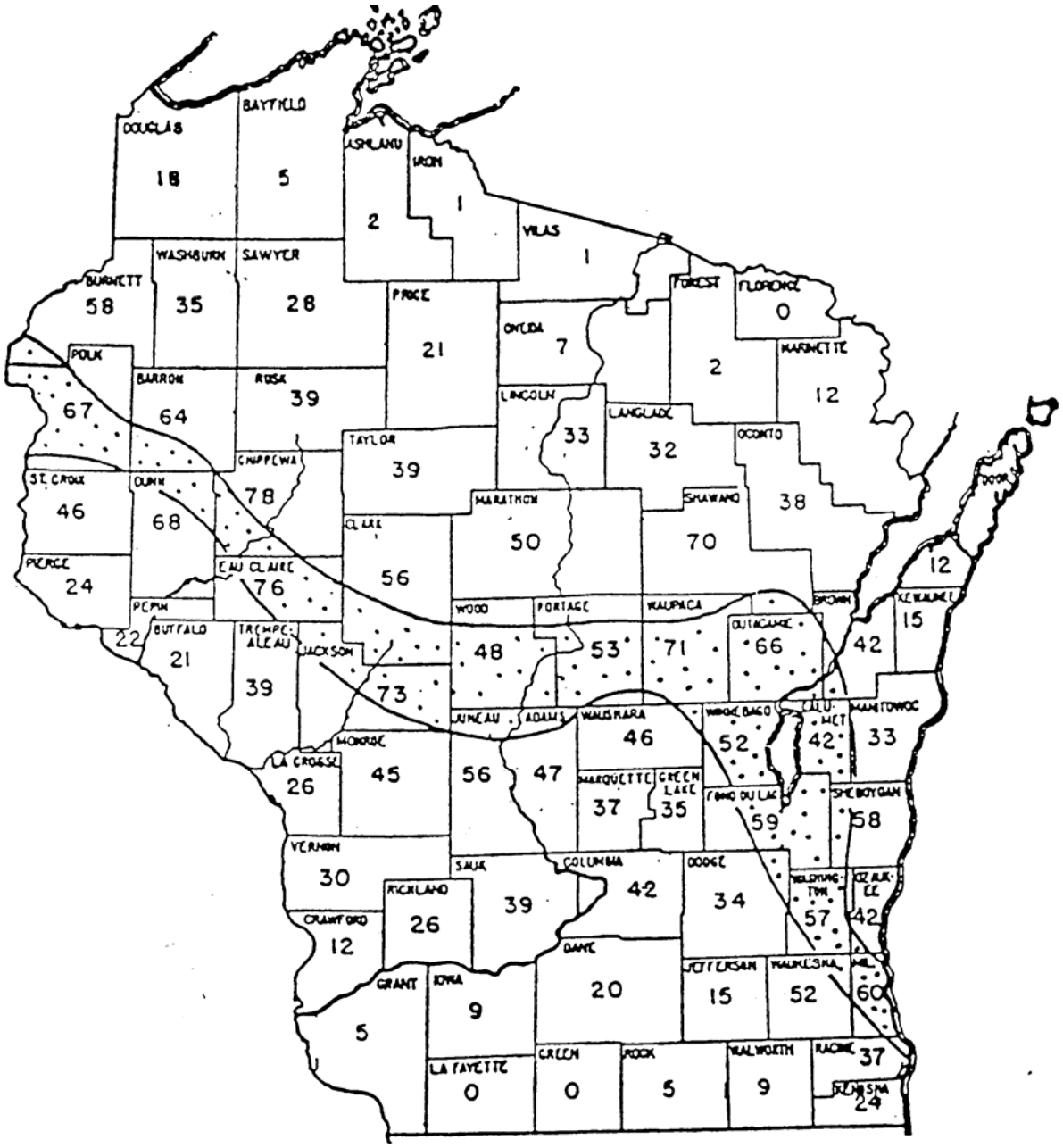
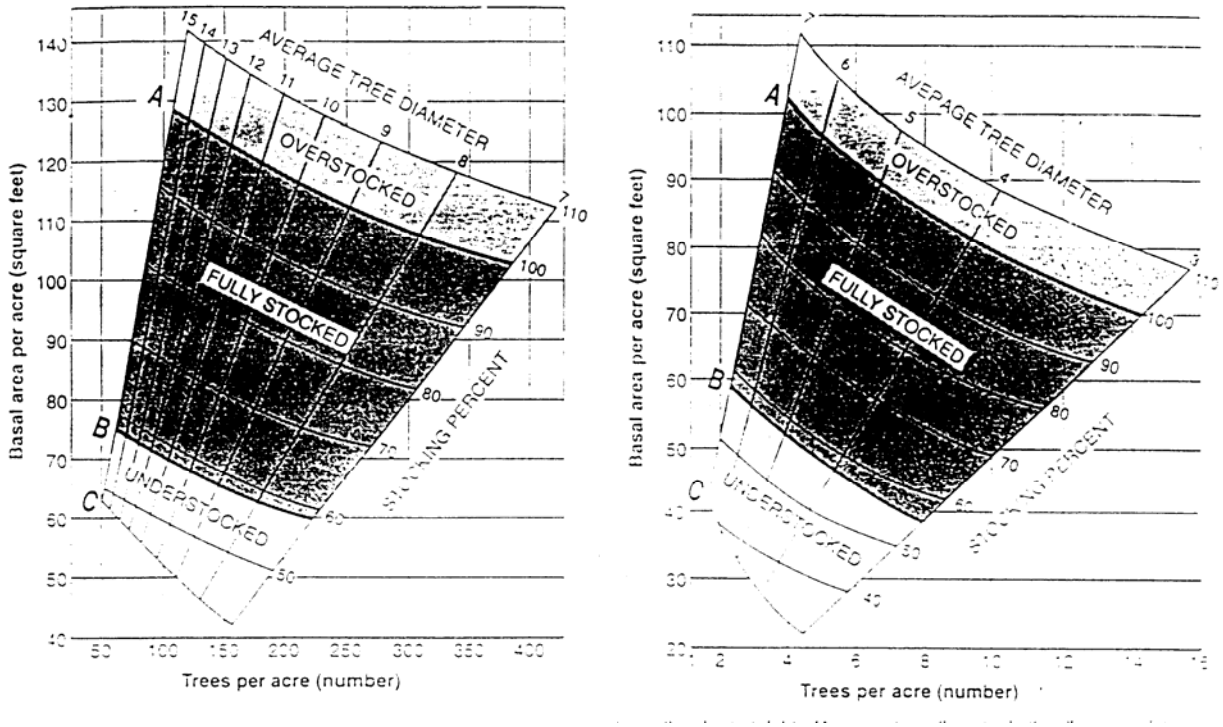


Figure 52.1 Upland Central Hardwood Stocking Charts

Relation of basal area, number of trees, and average tree diameter to stocking percent for upland central hardwoods (Gingrich 1971)



For average tree diameters 7 to 15, use the chart at left; for diameters 3 to 7, use the chart at right. (Average tree diameter is the diameter of the tree of average basal area.) On both charts the area between curves A and B indicates the range of stocking where trees can fully utilize the site. Curve C shows the lower limit of stocking necessary to reach the B level in 10 years on average sites.